matter, as well as to further clarify the claimed invention. These amendments are believed to be proper, do not introduce new matter, and serve to place the application in condition for continued examination and allowance.

In the Final Office Action mailed July 2, 2001 on application no. 09/104,947, claims 1-7, 11-14, and18-20 were rejected. Claims 8-10 and 15-17 have been withdrawn from consideration. Claims 1-7, 11-14 and 18-32 are currently pending in the application. Claims 1-7, 11-14 and 18-20 were rejected under 35 USC 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The same claims were also rejected to under 35 USC 103(a) as being unpatentable over Nishida et al (U.S. Patent 5,189,577) in view of Best et al (Statutory Invention Registration H1221).

Rejection under 35 U.S.C. §112

Claims 1-7, 11-14 and 18-20 have been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The applicant respectfully disagrees with the rejection of claims 1 and 3 due to the premise that the phrase "a standard configuration" is vague and indefinite. The Examiner has asserted that disk drive standards are subjective and are subject to change over time. Applicant respectfully disagrees with this perception.

First, standards for disk drives do exist outside of OEM and supplier specifications. The Electronic Industries Alliance has promulgated a standards specification discussing the small form factor (3.5 inch) drive (see "Form Factor of 3.5" Disk Drives," Rev. 1.3, January 27, 2001, see also Rev. 1.1, June 5, 1995). This organizational body has produced the Standards and Publications in accordance the American National Standards Institute (ANSI).

In contrast to the Examiner's assertion that leaders in the industry can "force the competition to accept" the standard, the EIA standard was voted on throughout the drafting process by companies composing various areas in the industry. The list of such

companies which approved the standard included 3M, Adaptec, Hewlett Packard, IBM, Maxtor, and Methode in addition to Seagate. It should now be clear that the use of the phrase "standard configuration" in claim 1 is not vague and indefinite under 35 USC 112, second paragraph.

The disc "standard diameter" for a 3.5 inch standard configuration is described on page 18, line 15 of the description as having " standard 95mm discs"; likewise, one skilled in the art would recognize that there are also standard diameters relative to other standard configurations of disc drives. As noted in the Magnetic Storage Handbook, 2d Edition, (Mee and Daniel, McGraw Hill, 1996), the standard diameter for a disc drive with a 3.5 inch footprint is 95 mm (section 2.2.5.1, table 2.5; the table also lists other standard diameters for different form factor sizes). See also "Flow and Thermal Fields in Channels Between Co-Rotating Disks," IEEE Transactions on Components, Hybrids, and Manufacturing Technology, Vol. 11, No. 4, 587, December 1988, for a table of standard disc radius.

In light of the information presented above, Applicant respectfully submits that the terms "standard configuration" and "standard diameter" are not indefinite under 35 USC 112, paragraph 2. That being said, claims 1 and 3 are now believed to be in condition for allowance. In addition, claims 2, 4-7, 11-14, 18-20 and 21-29 are also allowable as they depend from allowable claims. Reconsideration and withdrawal of the rejection is respectfully requested.

Rejection under 35 U.S.C. § 103

Claims 1-7, 11-14 and 18-20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishida et al in view of Best et al. In order to establish a prima facie case of obviousness, three basic criteria must be met. First, the prior art references must teach or suggest all the claim limitations. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Third, there must be a reasonable expectation of success.

As stated above, the first criteria of a prima facie case of obviousness, namely that the references must teach or suggest all of the claim limitations, has not been met. In applying a 103 rejection, the claimed invention as a whole must be considered. Neither Nishida nor Best, either alone or in combination, teach or suggest all of the claim limitations required in order to combine a smaller than standard disc with a standard housing configuration.

While Nishida does claim the 3.5 inch footprint, it doesn't make any claims related to the size of the discs or the RPM at which they spin. Best claims a 10,000 RPM drive, but in a 2.5 inch footprint, which is assembled into a grouping of at least four of these small drives labeled as direct access storage devices (DASD) to fill up a standard 5.25 inch form factor in a personal computer. (See FIG. 11) The use of 65 mm disc in this form factor size is not unique, but rather a standard size to use in individual 2.5 inch drives. (See the Magnetic Storage Handbook, 2d Edition, (Mee and Daniel, McGraw Hill, 1996), section 2.2.5.1, table 2.5) Best does not utilize discs that are smaller than the standard diameter expected for this size of a drive. The combination of the references does not teach the claim limitations of the current invention.

In addition, neither Nishida nor Best contemplate or claim the power relationship between torque and run current created by the use of a smaller than standard drive in a standard form factor. As found in amended claims 1 and 3, as well as new claims 22-23, 26, 30and 32 of the current invention, the power relationship is an integral part of the current invention. The support for the new claims and amendments may be found on P. 9. L. 17-26 of the specification and in basic, well-known rules of physic and electronics. By utilizing smaller than standard discs (for example, 84mm in diameter), the windage load acting on the spinning discs is significantly reduced when compared to a similar arrangement of 95mm diameter discs. As discussed at length below, reducing the torque required to rotate the disc stack reduces the current to drive the motor, thus ultimately reducing the power needed by the drive to spin the disc stack.

Co-rotating disc flow has been widely researched since the 1980's. Several relationships between geometry and torque have been described in the literature. Torok and Gronseth from "Flow and Thermal Fields in Channels Between Corotating Disks" describe a relationship between geometry and torque as follows. "The disk torque is obtained by integrating the product of the element shearing stress, the element area, and the radial moment arm over the entire disk surface area." The relationship is shown below:

$$M\ (Nt \cdot m) = \rho B^5 \Omega^2 \sum 2\pi r^2 \Delta r \tau^e$$

where B is equal to disc outer radius, Ω equals rotational speed, ρ equals fluid density, R equals local radius, r equals local radius and τ equals shear stress.

For typical electric motors torque is proportional to current. As described by ohms law, power is equal to the current squared multiplied by resistance. Reducing torque to spin the pack reduces the current to drive the motor. Reducing current to drive the spindle ultimately reduces power. Claims 1 and 3 have now been amended to describe this basic, yet integral relationship between torque, current and the reduced diameter of the discs contained in the smaller than standard disc stack as found in the current invention. New claims 22-23, 26, 30 and 32 also incorporate this relationship.

Based on the above remarks and the amended and new claims, it is clear that the first element of a prima facie case of obviousness has not been shown. Neither Nishida nor Best teach or suggest all of the claim limitations as discussed above.

The second criteria for the establishment of a prima facie case of obviousness requires that there be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify or combine the references. As will be discussed below, this is not the case in connection with the application at hand.

Acceptance of initial 10,000 rpm disk drives with 95mm diameter discs was limited due to the increased power consumption when compared to typical 7,200 rpm disk drives with 95mm diameter discs. To be more specific, power supplies and cooling

fans in many cabinets or enclosures containing disk drives could not support the higher power dissipation of 10,000 rpm disk drives with 95mm diameter discs. The use of 84mm discs reduced the drive operating power significantly enough so they could be used in the same cabinets and enclosures designed for 7,2000 rpm disc drives with 95mm diameter discs. Since new cabinets or enclosures with increased cooling and power requirements were not required, 10,000 rpm disk drives with 84mm diameter disks were widely accepted. Another benefit of reduced diameter discs is that the actuator geometry can also be reduced yielding lower inertia and faster seek times (time to move from one track to another). The combination of faster seek times and reduced power and cooling requirements was instrumental in 10,000 rpm drives with 84mm discs replacing 7,200 rpm drives in a majority of main stream file server applications. The end result of the current invention is that a drive is produced that has a higher rpm, cooler operation and reduced latency while still maintaining the same or reduced power budget and improving overall performance.

As discussed above in the section pertaining to the first criteria, Best does not provide any motivation to one skilled in the art to reduce the size of a disc while maintaining the standard housing configuration. As discussed above, Best teaches the use of four 2.5 inch form factor drives with standard diameter discs to occupy the same space inside of a computer as that of a disc drive with a 5.25 inch form factor. There is no use of a smaller than standard disc in the drives that make up the array. Prior to the use of the current invention in Seagate's disc drives, the drive industry was developing disc diameters to be as large as possible within the standard configuration of the disc drive. Nishida provides for only a drive that rotates a stack of discs at 10,000 rpm. Neither Nishida nor Best suggest of the use of a smaller than standard disc in a drive that spins at 10,000 rpm. There is no implicit or explicit motivation in either reference to combine the references to produce the invention currently disclosed. As discussed above, there is no suggestion of the relationship between the size of the discs, the speed at which a stack of discs is rotated and the power requirements of the drive. Amended claims 1 and 3, along with new claims 22-23, 26, 30 and 32 do contemplate the

interconnectivity of all of these elements in order to produce a commercially viable disc drive.

A final consideration tied to the above relationship is that of the heat generated by the operation of the drive itself. As discussed above, the use of smaller than standard discs in a disc stack rotated at 10,000 rpm allowed for cooler overall operation of the drive when compared to the use of standard 95 mm discs in a disc stack. New claims 23 and 30 incorporate this relationship. Once again, there is no suggestion or motivation to combine the references to provide for cooler operation of the drive as a whole.

There is no motivation to combine Best and Nishida. While in hindsight, it may appear obvious to combine the two, this is an impermissible method for determining obviousness. Without the use of the current specification as a blueprint, there would be no evidence of any suggestion, teaching or motivation to combine the references in order to arrive at the current invention. Without the use of hindsight there would be no motivation to combine Best and Nishida, namely using a smaller than standard disc in a standard footprint and then spinning the disc(s) at 10,000 RPM.

Upon review of the above remarks it is clear that there is no motivation or suggestion to modify or combine Best and Nishida. Thus, the second criteria for a prima facie case of obviousness has not been met.

The third criteria required for a prima facie case of obviousness is that there must be a reasonable expectation of success. The combination of the two references does not provide that expectation. The combination of the references would result in a disc drive rotating the standard size 95 mm discs in a 3.5 inch standard footprint at 10,000 rpm. As discussed above, a drive of this configuration would produce more heat and require more power than could be accommodated by existing cabinets. The existing cabinets can only tolerate the heat created by traditional 7,200 rpm drives in a 3.5 inch footprint. In addition, the power budgets dictated by the cabinets were not flexible above the amounts set by the earlier, slower drives. This is a clear indicator that there could not

be a reasonable expectation of success for a drive created by the combination of the two references at hand.

By reducing the diameter of the discs, but yet spinning them faster, the invention has created a drive that maintains if not reduces the power requirements of the pre-existing cabinets while reducing latency times. In addition, operational heat tolerances are not exceeded. As discussed here and above, there could not be a reasonable expectation of success with the combination of Nishida and Best, and thus the third criteria for a finding of obviousness has not been met.

Claims 3, 4, 11 and 18 were also rejected under 35 U.S.C. § 103(a). The line of reasoning for these claim rejections is the same as detailed above. The arguments as made above equally apply to these claims as well; the prima facie case of obviousness has not been met.

Claims 5, 7, 13, and 20 are dependent claims which ultimately depend from claim 1 or claim 3, which are believed to be patentable over the prior art of record for the reason discussed hereinabove. Claims 5 and 7, along with amended claims 13 and 20 are thus allowable as dependent claims depending from allowable independent claims and providing additional limitations thereto. Reconsideration and withdrawal of the rejection of these claims are respectfully requested.

Claims 6, 12, 14, and 19 are also dependent claims which ultimately depend from claim 1 or claim 3, which are believed to be patentable over the prior art of record for the reason discussed hereinabove. Claims 6, 12, 14, and 19 are thus allowable as dependent claims depending from allowable independent claims and providing additional limitations thereto. Reconsideration and withdrawal of the rejection of these claims are respectfully requested.

Finally, new claims 21-29 that ultimately depend from claim 1 or claim 3 are believed to be patentable over the prior art of record for the reasons discussed above. These claims are allowable as they depend from allowable independent claims and provide additional limitations. In addition, it is also believed that new claim 27 and its dependents also are patentable over the prior art and are thus allowable.

The applicant respectfully disagrees with the Examiner's statement of Official Notice, "that disks of 84mm are known in the art", and requests that the Examiner provide sufficient citation to support this assertion and show it was applicable at the time of the invention. If "disks of 84 mm are known in the art," it is due to competitors and others in the industry have adopted this size in light of the commercial success of the Seagate drives utilizing this innovation. Applicant requests that a sufficient citation be provided to show this assertion.

Sufficiency of the Declaration

The applicant also respectfully disagrees with the Examiner's assertion that there has been no showing that the claimed features of the invention were responsible for the commercial success of the drives implementing this design. The Declaration under 37 CFR 1.132 filed September 14, 1999 clearly shows that there has been an enormous amount of commercial success and competitive recognition due to the present invention. Applicant contends that a nexus has been created between the statements made in the Declaration and the subject matter as claimed, especially in light of the newly added claims. The nexus is required if the evidence of nonobviousness is to be given significant weight. This nexus can be further defined as a "factually and legally sufficient connection between the objective evidence of nonobviousness and the claimed invention so that the evidence is of probative value in the determination of nonobviousness." MPEP 716.03(b). Applicant has shown that such a nexus has been created between the evidence as presented in the declaration and the invention as claimed.

Throughout the declaration, the primary factors attributed towards the success of the disc drive family of product's success has been the reduced seeks times, and cooler operation and reduced power requirements from competitors 10,000 rpm drives. For example, in Exhibit D it is stated that "Cheetah 9LP/18, doubled drive capacity and introduced the first high-performance disc drive with reduced-diameter media technology <u>for substantially cooler drive operation and faster seek times</u>." (emphasis

added). This drive, due to the use of smaller than standard discs, operates at a cooler temperature than other 10,000 rpm drives in the same 3.5 inch configuration spinning standard sized discs. As discussed above and claimed in new claims 23 and 30, the cooler operation made it possible to use the drives incorporating the present invention into enclosures that previously had utilized cooler, but slower, 7,200 rpm drives.

Yet another example of the connection between the claimed invention and the commercial success of the implementation of the invention can be found in the power requirements of a drive utilizing the present invention. In Exhibit A of the declaration, it is stated that the Cheetah 9LP/18HH has improved power efficiency, up to a 25% reduction in power from its predecessors which utilized standard size discs. As referenced in the discussion of the second criteria for obviousness under 35 USC §103, this power efficiency allowed this and following generations of the drive to be implemented into existing enclosures. Exhibit C of the declaration also notes the reduction in power requirements, along with the reduced seek times provided by the smaller diameter discs. The reduction in power requirements for drives implementing smaller than standard discs are claimed in amended independent claims 1 and 3, as well as in new claim 30, along with their mutual dependent claims. The detailed description also discusses the power requirements at p. 9, lines 9-18. Thus, there is a connection between the claimed features of the invention and the commercial success of the invention.

Specific examples of the appreciation of the benefits of the invention may be found in Exhibits C and D which refer to the statements of representatives of Hewlett-Packard (HP) and Dell that discuss the contribution of the performance of this family of drives to their respective products. For example in Exhibit C, the worldwide manager of HP's Network Server Division states that the use of "Cheetah innovation and technology" in HP product has provided "a definite advantage" for their customers. The technology referred to is that which is embodied in the claimed invention. Exhibit D provides statements by a representative of Dell that provides that the industry-leading technology of a 10,000 rpm drive has been a key asset in various server and

storage products. These examples illustrate the connection between the commercial success of products incorporating this technology (see Exhibit D) and the claimed invention. Finally, the invention has been recognized by others in the industry. Exhibit F details the large amount of recognition by leading industry publications, such as PC Computing and C/NET. Specifically, the Cheetah 9LP was recognized for its breakthrough technology. Exhibit E provides a detailed list of awards and recognition for both the Cheetah 9LP and 18HH from publications and websites. This recognition came not only from US publications, but also those originating from the markets of major competitors such as Asia, Germany, and Korea.

Upon review of the amended and new claims in view of the declaration of September 14, 1999, it is clear that the claimed features of the invention are responsible for the commercial success of the invention. For this reason, the declaration is sufficient to rebut a finding of obviousness. As argued in the response filed April 17, 2001, the declaration provides the strong evidence of secondary considerations to overcome an objection of obviousness. Therefore, Applicant requests that the rejection of claims 1-7, 11-14 and 18-20 be withdrawn.

CONCLUSION

In conclusion, Applicant submits that the claims of the present invention particularly point out and distinctly claim the subject matter that is regarded as the invention. Thus, the rejection of claims 1-7, 11-14 and 18-20 under 35 USC §112, second paragraph should be withdrawn.

In addition, the present invention as claimed is nonobvious in view of the prior art of record or any combination thereof. Furthermore, the Declaration under 37 CFR 1.132 filed on September 14, 1999 provides strong evidence of secondary consideration to overcome an obviousness rejection. Therefore, the rejection of claims 1-7, 11-14, and 18-20, as amended, under 35 U.S.C. § 103 should be withdrawn.

Therefore, it is respectfully requests that pending claims 1-7, 11-14 and 18-30 be reconsidered and allowed. Favorable action with respect to the present application is respectfully requested.

Respectfully submitted,

SEAGATE TECHNOLOGY LLC
(Assignee of Entire Interest)

02 January 2002
Date

Jennifer M. Buenzow

Jennifer M. Buenzow, Reg. No. P-50,124
SEAGATE TECHNOLOGY LLC
Intellectual Property Dept. - SHK2LG
1280 Disc Drive
Shakopee, MN 55379-1863
(952) 402-3436 (telephone)
(952) 402-2657 (facsimile)

APPENDIX: MARKED UP AMENDMENTS

Claims:

1. (~~Twice~~ Thrice Amended) A disc drive assembly including:

a disc drive housing comprising a standard configuration; and

a disc drive supported in the housing having:

a stack of rotatable rigid recording discs mounted to a hub where ~~wherein~~ each ~~recording~~ disc has a diameter smaller than the standard diameter of a rigid disc associated with the standard configuration, the hub being operatively configured for mounting on a spindle motor, where due to the smaller diameter of the discs a reduced torque is required to rotate a stack of smaller diameter discs than is required to rotate a stack of standard diameter discs, and;

an ~~head/actuator~~ actuator assembly for reading data ~~to~~ from and writing data ~~from~~ to a selected ones of the discs.

2. (Thrice Amended) The disc drive assembly of claim 1, wherein the disc drive housing has a 3½ inch configuration and each of the recording discs is a magnetic recording disc that has a diameter that is smaller than the standard configuration of 95 mm.

3. (~~Thrice~~Four Times Amended) A disc drive assembly including:

a disc drive housing comprising a standard configuration;

an actuator assembly comprising at least one actuator arm with a transducer, the transducer being attached to a

distal end of the actuator arm, with each actuator assembly operating to position each transducer adjacent a respective surface of a rotating rigid recording disc; and

means for ~~stacking and~~ rotating a ~~plurality~~ stack of rigid recording discs within the housing, each disc having at least one recording surface and having a diameter smaller than the diameter of a rigid disc associated with the standard configuration, where the means requires less torque to rotate the stack of smaller diameter discs than is required to rotate a stack of standard diameter discs. ~~the number of discs within the housing being greater than the number of discs ordinarily contained in the standard configuration;~~

~~a plurality of transducers, each associated with a recording surface of one of the discs; and~~

~~actuator means supporting the plurality of transducers for positioning each transducer adjacent a respective surface of a disc.~~

4. (Thrice Amended) The disc drive assembly of claim 3, wherein the disc drive housing has a 3½ inch configuration and each of the recording discs is a magnetic recording disc that has a diameter that is smaller than the standard configuration of 95 mm.

5. (Twice Amended) The disc drive assembly of claim 1, wherein each of the recording discs is a magnetic recording disc and the stack of discs are mounted to a spindle motor for operational rotation at 10,000 rpm.

6. The disc drive assembly of claim 2, wherein each of the magnetic recording discs has a diameter of 84 mm.

7. (Twice Amended) The disc drive assembly of claim 2, wherein the stack of discs are mounted to a spindle motor for operational rotation at 10,000 rpm.

11. (Twice Amended) The disc drive assembly of claim 2, wherein the disc drive housing has a 3½ inch low-profile configuration and the stack of magnetic recording discs comprises six magnetic recording discs within the housing which is greater than a~~the~~ number of discs of the standard configuration of five discs.

12. The disc drive assembly of claim 11, wherein each of the magnetic recording discs has a diameter of 84 mm.

13. (Thrice ~~Twice~~ Amended) The disc drive assembly of claim 3, ~~wherein~~ where the recording discs are magnetic recording discs. ~~and the means for stacking and rotating includes a spindle motor supporting the plurality of discs for operational rotation at 10,000 rpm.~~

14. The disc drive assembly of claim 4, wherein each of the magnetic recording discs has a diameter of 84 mm.

18. (Twice Amended) The disc drive assembly of claim 4, wherein the disc drive housing has a standard 3½ inch low-profile configuration and the number of magnetic recording discs in the housing is six which is greater than the number of discs of the standard configuration of five discs.

19. The disc drive assembly of claim 18, wherein each of the magnetic recording discs has a diameter of 84 mm.

20. (Thrice~~Twice~~ Amended) The disc drive assembly of claim 18, wherein the means ~~for stacking and~~ rotating includes a spindle motor supporting the plurality of discs for operational rotation at 10,000 rpm.

21. (New) The disc drive assembly of claim 1 further comprising the spindle motor.

22. (New) The disc drive assembly of claim 21 where the reduction in required torque correspondingly reduces a run current required to rotate the stack of smaller than standard discs than is required to rotate the stack of standard diameter discs.

23. (New) The disc drive assembly of claim 21 where the spindle motor rotating the stack of smaller diameter discs has a reduced power dissipation over a spindle motor rotating a stack of standard diameter discs.

24. (New) The disc drive assembly of claim 23 where the spindle motor rotating the stack of smaller diameter discs operates at a reduced temperature from a spindle motor rotating a stack of standard diameter discs.

25. (New) The disc drive assembly of claim 2 where a number of smaller diameter discs in the stack is greater than a number of standard diameter discs in the stack contained in a disc drive housing in the standard configuration.

26. (new) The disc drive assembly of claim 3 where the reduction in required torque by the means for rotating correspondingly reduces a run current required to rotate the stack of smaller than standard discs than is required to rotate the stack of standard diameter discs.

27. (New) The disc drive assembly of claim 13 where the means for rotating includes a hub operatively configured for mounting on a spindle motor.

28. (New) The disc drive assembly of claim 27 where the spindle motor operationally rotates at 10,000 rpm.

29. (New) The disc drive assembly of claim 28 where a number of smaller diameter discs in the stack rotated by the means is greater than a number of standard diameter discs in a stack contained in the standard disc drive housing configuration.

30. (New) A disc drive assembly comprising:

a disc drive housing comprising a standard 3 ½ inch low profile configuration; and

a disc drive supported in the housing having:

an actuator assembly comprising at least one actuator arm with a transducer, the transducer being attached to a distal end of the actuator arm, with each actuator assembly operating to position each transducer adjacent a respective surface of a rotating rigid magnetic recording disc;

a stack of rigid magnetic recording discs having a smaller than standard diameter of 84 mm, as compared to a standard diameter of 95mm, a number of the stack of smaller than standard diameter discs being greater than a number of standard diameter discs contained in the disc drive housing;

a hub upon which the stack of smaller than standard 84 mm discs is mounted, the hub being operatively configured for mounting to a spindle motor which operationally rotates the stack of discs at 10,000 rpm, where a torque required to rotate the smaller than standard stack of discs is less than that required to rotate a stack of standard diameter discs, where the reduction in required torque correspondingly reduces a run current required by the spindle motor to rotate a stack of smaller than standard discs than is required to rotate the stack of standard diameter discs.

31. (New) The disc drive assembly of claim 28 where the spindle motor rotating the stack of smaller diameter discs has a reduced power dissipation over a spindle motor rotating a stack of standard diameter discs.

32. (New) The disc drive assembly of claim 29 where the spindle motor rotating the stack of smaller diameter discs operates at a reduced temperature from a spindle motor rotating the stack of standard diameter discs.